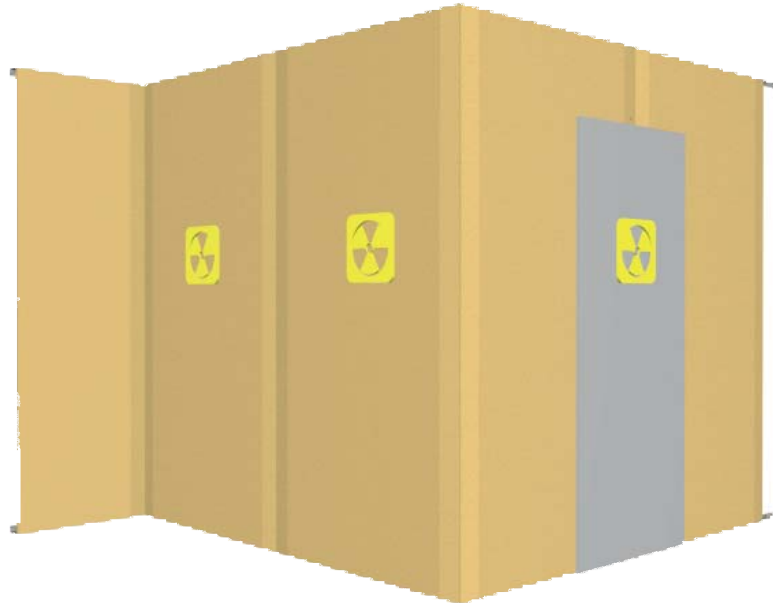


## 3.6.5

# X-Ray Shielding Walls and Ceilings

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### INTRODUCTION

GIB X-Block® is a lead free plasterboard system used as an effective radiation barrier. Barium Sulphate in the GIB X-Block plasterboard and compound provide protection against X-rays.

X-ray shielding requirements are usually specified as a thickness of lead. The lead equivalence of GIB X-Block systems depend on the energy level of the radiation. Tables 1 and 2 state the lead equivalence of GIB X-Block systems at various X-ray energy levels. Always seek advice from a Health Physicist to ensure that the requirements for radiation shielding are met.

This section contains radiation test results, shielding requirements, systems, installation instructions and construction details for GIB X-Block systems. *[Refer to Section 2.3 for more information on X-ray resistance]*

## RADIATION TEST RESULTS

**TABLE 1 GIB X-Block® Millimeters of Lead Equivalence for Different X-Ray Energies**

13mm GIB X-Block® Lead Equivalence (mm)				
X-ray Energy (kVp)	1 Layer	2 Layers	3 Layers	4 Layers
80	0.8	1.6	2.4	–
100	0.75	1.5	2.25	2.9
125	0.5	1.0	1.4	1.9
150	0.4	0.7	1.0	1.3

Uncertainties ± 0.1mm

Source: National Radiation Laboratory Reports 24062003/1, 24062008, 20022009.

\*Quote from Report 20022009: 'Determination of lead equivalence for 4 layers of X-Block Plasterboard at 80kVp was not feasible owing to the extremely low transmission of the X-rays through this sample thickness'.

kVp - kilovolts peak. Maximum voltage applied across the X-ray tube. The kVp controls the maximum energy of the emitted X-rays.

**TABLE 2 GIB X-Block® Mass of Lead Equivalence for Different X-Ray Energies**

13mm GIB X-BLOCK® Lead Equivalence (kg/m <sup>2</sup> )				
X-ray energy (kVp)	1 Layer	2 Layers	3 Layers	4 Layers
80	9.1	18.1	27.2	–
100	8.5	17.0	25.5	32.9
125	5.7	11.3	15.9	21.5
150	4.5	7.9	12.5	14.7

Source: Calculated from Table 1 using the density of lead (11340 kg/m<sup>3</sup>)

### X-RAY RESISTANCE ENERGY LEVELS

X-ray radiation is measured in kilovolts peak (kVp). Depending on the type of radiation equipment used in the room, diagnostic facilities will have different requirements for shielding:

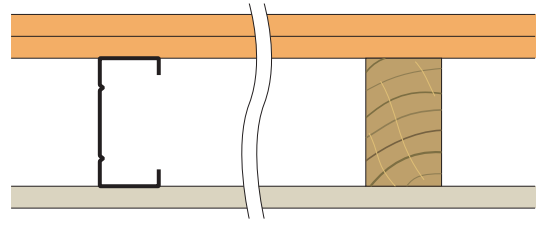
- CT 120-140 kVp
- General radiographic rooms 60-90 kVp
- Dental 60-80 kVp
- Mammography 25-35 kVp

# NON-FIRE RATED

## KX1

**WALL LINING:** [Side 1] 2 layers of 13mm **GIB X-Block**  
[Side 2] 1 layer of 13mm **MastaShield**

**FRAME:** Steel or timber studs at maximum 600mm centres  
[13mm **MastaShield** can be substituted with 13mm **WaterShield**]  
[Timber wall heights calculated using MGP10]

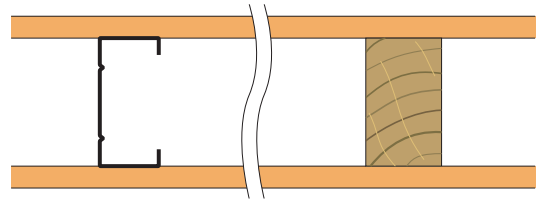


FRL - / - / -	Stud Size (mm)		Max Height UDL 0.25 kPa (m)		Width (mm)	Acoustics Rw (Rw + Ctr)			
	Stud Depth	Stud BMT/ Stud Width	Non-Load Bearing Studs at 600mm	Non-Load Bearing Studs at 450mm		No Insulation	R1.5 EarthWool	65mm Polyester ASB3/TSB3	Acoustic Report Day Design 3094-4
	Steel 64	0.5 0.75	3.72 4.22	3.93 4.43	103	44 (38)	51 (42)	51 (42)	
Timber 70	35 45	4.01 4.14	4.16 4.31	109					

## KX2

**WALL LINING:** [Side 1] 1 layer of 13mm **GIB X-Block**  
[Side 2] 1 layer of 13mm **GIB X-Block**

**FRAME:** Steel or timber studs at maximum 600mm centres  
[Timber wall heights calculated using MGP10]

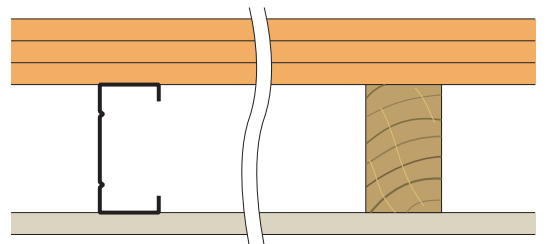


FRL - / - / -	Stud Size (mm)		Max Height UDL 0.25 kPa (m)		Width (mm)	Acoustics Rw (Rw + Ctr)			
	Stud Depth	Stud BMT/ Stud Width	Non-Load Bearing Studs at 600mm	Non-Load Bearing Studs at 450mm		No Insulation	R1.5 EarthWool	65mm Polyester ASB3/TSB3	Acoustic Report Day Design 3094-4
	Steel 64	0.5 0.75	3.72 4.22	3.93 4.43	90	40 (35)	49 (40)	48 (40)	
Timber 70	35 45	4.61 4.70	4.72 4.84	96					

## KX3

**WALL LINING:** [Side 1] 3 layers of 13mm **GIB X-Block**  
[Side 2] 1 layer of 13mm **MastaShield**

**FRAME:** Steel or timber studs at maximum 600mm centres  
[13mm **MastaShield** can be substituted with 13mm **WaterShield**]  
[Timber wall heights calculated using MGP10]

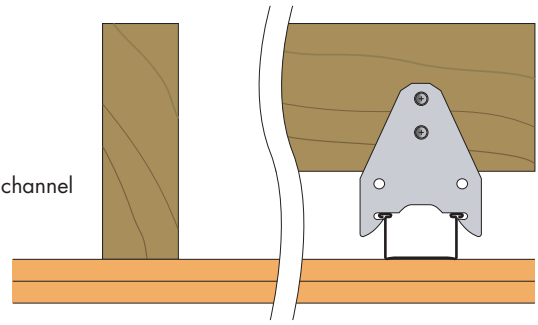


FRL - / - / -	Stud Size (mm)		Max Height UDL 0.25 kPa (m)		Width (mm)	Acoustics Rw (Rw + Ctr)			
	Stud Depth	Stud BMT/ Stud Width	Non-Load Bearing Studs at 600mm	Non-Load Bearing Studs at 450mm		No Insulation	R1.5 EarthWool	65mm Polyester ASB3/TSB3	Acoustic Report Day Design 3094-4
	Steel 64	0.5 0.75	3.72 4.22	3.93 4.43	116	47 (41)	55 (45)	54 (45)	
Timber 70	35 45	4.01 4.14	4.16 4.31	124					

## NON-FIRE RATED

### KX4

- CEILING LINING:** 2 layers of 13mm **GIB X-Block**
- FRAME:** [Option 1] Steel or timber ceiling joists  
 [Option 2] Steel or timber joists with with A-clips and furring channel



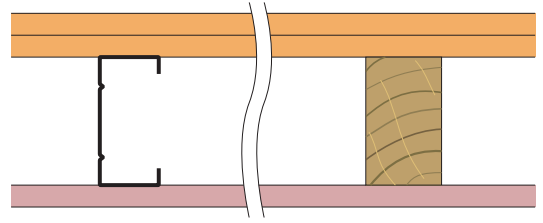
FRL - / - / -	Max Framing Centres (mm)	Acoustics Rw (Rw + Ctr)	
	600	35 (33)	Acoustic Report Day Design 3094-4



## KX5

**WALL LINING:** [Side 1] 2 layers of 13mm **GIB X-Block**  
[Side 2] 1 layer of 13mm **FireShield**

**FRAME:** Steel or timber studs at maximum 600mm centres  
[13mm **FireShield** can be substituted with 13mm **MultiShield** or 13mm **ImpactShield** or 13mm **QuadShield**]  
[Timber wall heights calculated using MGP10]

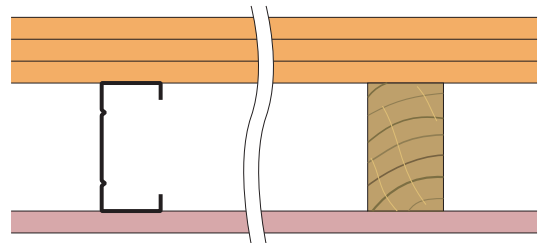


FRL - /60/60 rated from both sides Fire Report FAR 2320	Stud Size (mm)		Max Height UDL 0.25 kPa (m)		Width (mm)	Acoustics Rw (Rw + Ctr)			
	Stud Depth	Stud BMT/ Stud Width	Non-Load Bearing Studs at 600mm	Non-Load Bearing Studs at 450mm		No Insulation	R1.5 EarthWool	65mm Polyester ASB3/TSB3	Acoustic Report Day Design 3094-4
	Steel 64	0.5 0.75	3.72 4.22	3.93 4.43	103	45 (39)	52 (43)	52 (43)	
Timber 70	35 45	4.61 4.70	4.72 4.84	109	43 (37)	46 (41)	-		

## KX6

**WALL LINING:** [Side 1] 3 layers of 13mm **GIB X-Block**  
[Side 2] 1 layer of 13mm **FireShield**

**FRAME:** Steel or timber studs at maximum 600mm centres  
[13mm **FireShield** can be substituted with 13mm **MultiShield** or 13mm **ImpactShield** or 13mm **QuadShield**]  
[Timber wall heights calculated using MGP10]

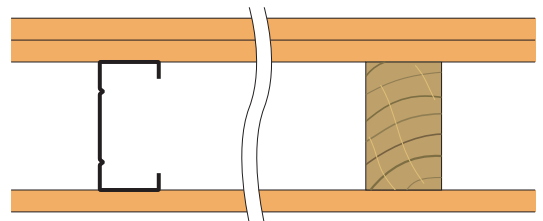


FRL - /60/60 rated from both sides Fire Report FAR 2320	Stud Size (mm)		Max Height UDL 0.25 kPa (m)		Width (mm)	Acoustics Rw (Rw + Ctr)			
	Stud Depth	Stud BMT/ Stud Width	Non-Load Bearing Studs at 600mm	Non-Load Bearing Studs at 450mm		No Insulation	R1.5 EarthWool	65mm Polyester ASB3/TSB3	Acoustic Report Day Design 3094-4
	Steel 64	0.5 0.75	3.72 4.22	3.93 4.43	116	47 (41)	55 (47)	55 (47)	
Timber 70	35 45	4.61 4.70	4.72 4.84	124	46 (40)	49 (45)	-		

## KX7


**WALL LINING:** [Side 1] 2 layers of 13mm **GIB X-Block**  
[Side 2] 1 layer of 13mm **GIB X-Block**

**FRAME:** Steel or timber studs at maximum 600mm centres  
[Timber wall heights calculated using MGP10]



FRL - /60/60 rated from both sides Fire Report FAR 2320	Stud Size (mm)		Max Height UDL 0.25 kPa (m)		Width (mm)	Acoustics Rw (Rw + Ctr)			
	Stud Depth	Stud BMT/ Stud Width	Non-Load Bearing Studs at 600mm	Non-Load Bearing Studs at 450mm		No Insulation	R1.5 EarthWool	65mm Polyester ASB3/TSB3	Acoustic Report Day Design 3094-4
	Steel 64	0.5 0.75	3.72 4.22	3.93 4.43	103	44 (39)	53 (46)	53 (46)	
Timber 70	35 45	4.61 4.70	4.72 4.84	109	43 (38)	46 (42)	-		


## GENERAL REQUIREMENTS

	Non-Fire Rated	 Fire Rated
Install control joints in plasterboard walls at: <ul style="list-style-type: none"> <li>&gt; 12m maximum intervals</li> <li>&gt; All control joints in the structure</li> <li>&gt; Any change in the substrate material</li> </ul>	✓	✓
Use <b>GIB X-Block</b> jointing compound: <ul style="list-style-type: none"> <li>&gt; In the gap between the sheets</li> <li>&gt; To fill the recessed joints on every layer</li> <li>&gt; As the bedding coat with paper tape and as the second coat for the face layer. For the finish coat use <b>MastaFinish</b> or <b>MastaLite</b>.</li> <li>&gt; To fill any other gaps and to cover all face layer fastener heads.</li> </ul> Never joint sheets with fire sealant. <i>[Refer to Section 4]</i>	✓	✓
Treat all penetrations as shown in the construction details to maintain radiation protection or use lead of the appropriate thickness.	✓	✓
Use approved fire rated penetration details. Fire penetrations may require fire collars or other devices to maintain fire performance.		✓
Pack any gaps between the top of the wall and the underside of the roof covering with mineral fibre or other suitable fire resisting material. This maintains the fire rating of the system. <i>[Refer to mineral fibre manufacturers specifications for minimum widths required]</i>		✓
Use fire sealant around perimeter, vermiculite plaster is not permitted.		✓



For acceptable modifications or variations to fire rated systems. *[Refer to Section 2.3 Fire Resistance]*


## FRAMING

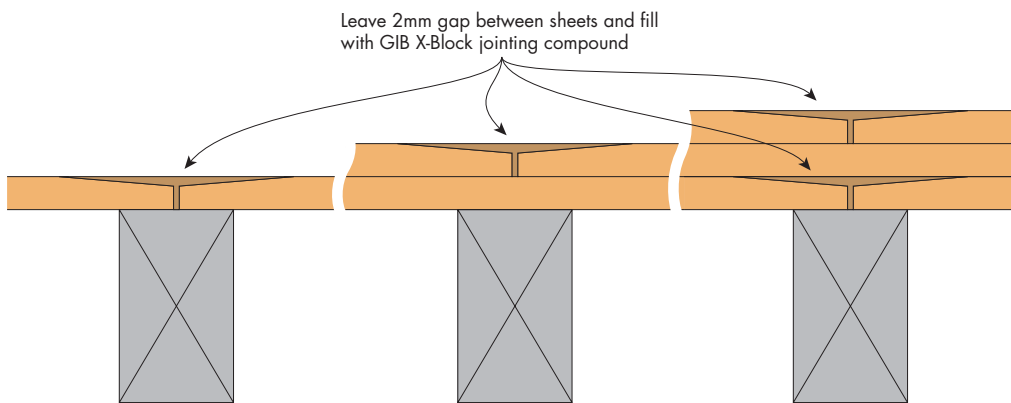
	Non-Fire Rated	 Fire Rated
Framing members must be spaced at 600mm maximum centres.	✓	✓



- > Noggings are permitted to assist the fixing of services.
- > Plumbing and electrical services must not protrude beyond the face of the stud.


## PLASTERBOARD LAYOUT

	Non-Fire Rated	 Fire Rated
<b>Vertical Layout Only</b>		
Sit <b>GIB X-Block</b> directly on the floor, leave no gap at the base of the sheet.	✓	✓
All recessed and butt joints must be backed by a framing member.	✓	✓
Leave a gap of 2mm between <b>GIB X-Block</b> sheets to allow <b>GIB X-Block</b> jointing compound to fill any gaps between and behind the sheets. [Figure 1]	✓	✓
Vertical joints must be 200mm minimum from the edge of any opening such as windows and doorways to minimise cracking at the joints.	✓	✓
Stagger recessed edges by 600mm minimum between layers and on opposite sides of the wall.	✓	✓
Stagger butt joints by 600mm minimum on adjoining sheets, between layers and on opposite sides of the wall.	✓	✓



**FIGURE 1** Completely Filling All Gaps and Recessed Joints

## PLASTERBOARD FIXING

	Non-Fire Rated	 Fire Rated
Drive screws to just below the sheet surface, taking care not to break the paper linerboard.	✓	✓
Do not fix plasterboard to steel more than 2mm BMT.	✓	✓
Use the 'Screw Only Method'.	✓	✓

### SCREW TYPE AND MINIMUM SIZE FOR THE INSTALLATION OF PLASTERBOARD TO STEEL

Plasterboard Thickness	1st Layer	2nd Layer	3rd Layer
13mm	25mm – 6g S screw	40mm – 6g S screw	60mm – 6g S screw

For steel up to 0.8mm BMT use Type 'S' fine thread needle point screws.  
For steel 0.8mm to 2.0mm BMT use Type 'S' fine thread drill point screws.

### SCREW TYPE AND MINIMUM SIZE FOR THE INSTALLATION OF PLASTERBOARD TO SOFTWOOD TIMBER

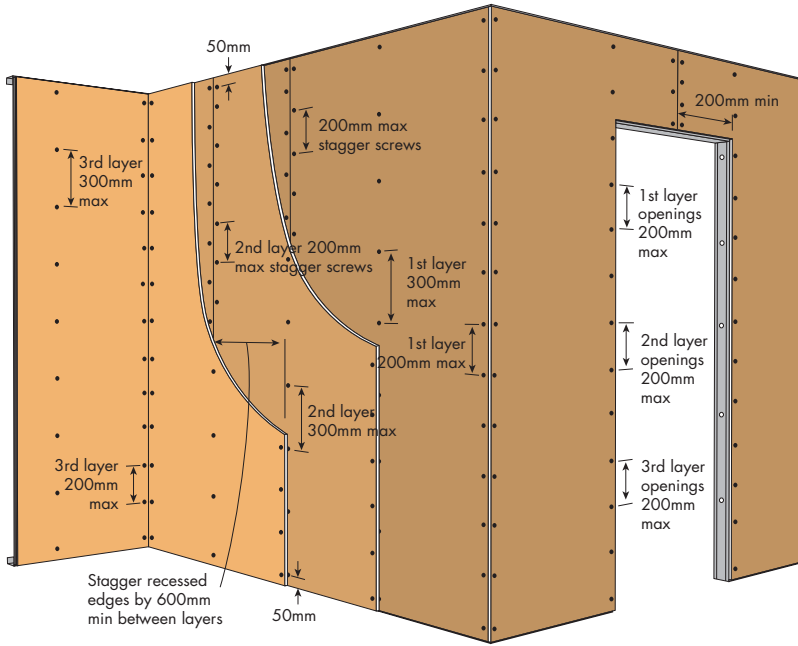
Plasterboard Thickness	1st Layer	2nd Layer	3rd Layer
13mm	30mm – 6g W screw	45mm – 6g W screw	65mm – 8g W screw

For timber use Type 'W' coarse thread needle point screws.



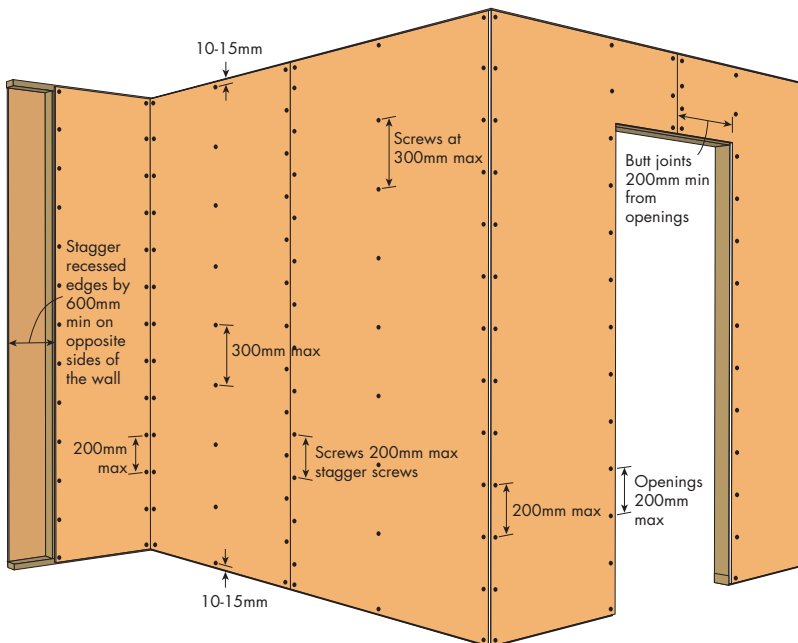


**FIGURE 4 X-Block 3 Layers – All Vertical on Steel Studs**  
Screw Only Method



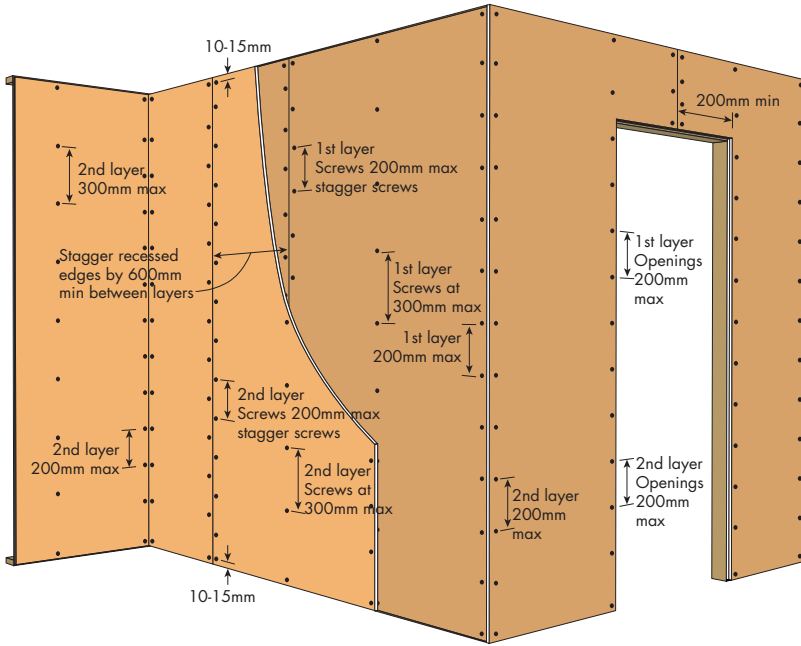
<b>Fixing</b>	Screw Only Method
<b>Sheet Layout</b>	1st, 2nd and 3rd layers: Vertical
<b>Perimeter</b>	Perimeter screws 10-15mm from sheet edges except at top and bottom tracks. Plasterboard must not be fixed to top and bottom tracks.
<b>Field</b>	1st, 2nd and 3rd layers: Fix at 300mm max centres
<b>Recessed Edges</b>	1st, 2nd and 3rd layers: Fix at 200mm max centres and stagger screws. Stagger recessed edges by 600mm min between layers and on opposite sides of the wall. All recessed edges must be backed by a stud.
<b>Butt Joints</b>	1st, 2nd and 3rd layers: Fix at 200mm max centres and stagger screws. Stagger butt joints by 600mm min on adjoining sheets, between layers and on opposite sides of the wall. All butt joints must be backed by a nogging.
<b>Internal and External Corners</b>	1st, 2nd and 3rd layers: Fix at 200mm max centres
<b>Openings</b>	1st, 2nd and 3rd layers: Fix at 200mm max centres
<b>Fire Sealant</b>	Use fire sealant around perimeter to maintain fire and acoustic integrity [Refer to Construction Details]
<b>Jointing 1st and 2nd Layers</b>	Completely fill recess joints and any gaps with GIB X-Block jointing compound. Paper tape is not required.
<b>Jointing Face Layer</b>	Use paper tape with two coats of GIB X-Block jointing compound. Fill any gaps with GIB X-Block jointing compound. Finish with a third coat of MastaFinish.

**FIGURE 5 X-Block 1 Layer – Vertical on Timber Studs**  
Screw Only Method



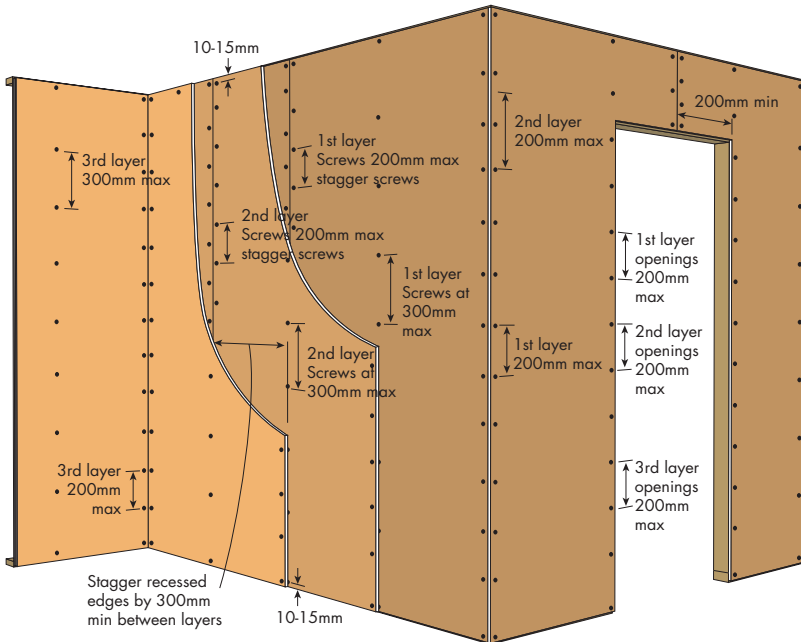
<b>Fixing</b>	Screw Only Method
<b>Sheet Layout</b>	Vertical
<b>Perimeter</b>	Perimeter screws 10-15mm from sheet edges
<b>Field</b>	Fix screws at 300mm max centres
<b>Recessed Edges</b>	Fix screws at 200mm max centres and stagger screws. Stagger recessed edges by 600mm min on opposite sides of the wall. Recessed edges must be backed by a stud.
<b>Butt Joints</b>	Fix screws at 200mm max centres and stagger screws. Stagger butt joints by 600mm min on adjoining sheets and on opposite sides of the wall. Butt joints must be backed by a nogging.
<b>Internal and External Corners</b>	Fix at 200mm max centres
<b>Openings</b>	Fix at 200mm max centres
<b>Fire Sealant</b>	Use fire sealant around perimeter to maintain fire and acoustic integrity. [Refer to Construction Details]
<b>Jointing Face Layer</b>	Use paper tape with two coats of GIB X-Block jointing compound. Fill any gaps with GIB X-Block jointing compound. Finish with a third coat of MastaFinish.

**FIGURE 6 X-Block 2 Layers – Vertical + Vertical on Timber Studs**  
Screw Only Method



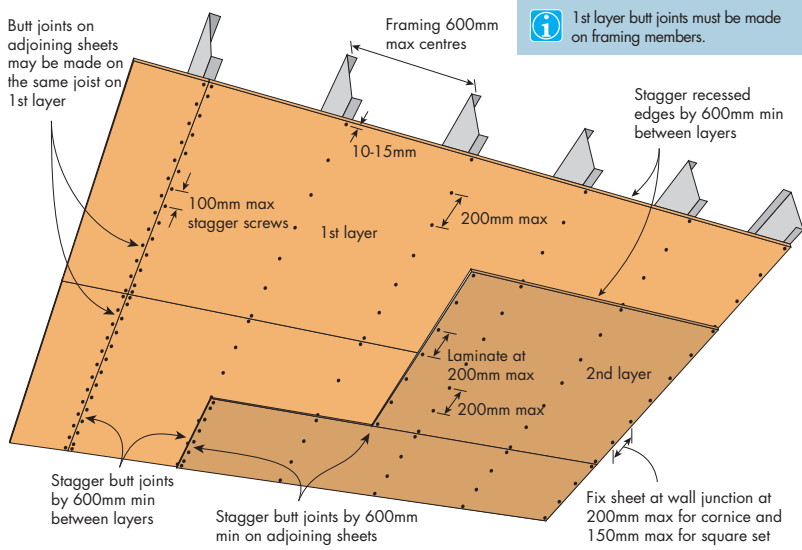
<b>Fixing</b>	Screw Only Method
<b>Sheet Layout</b>	1st layer: Vertical 2nd layer: Vertical
<b>Perimeter</b>	Perimeter screws 10-15mm from sheet edges
<b>Field</b>	1st and 2nd layers: Fix screws at 300mm max centres
<b>Recessed Edges</b>	1st and 2nd layers: Fix screws at 200mm max centres and stagger screws. Stagger recessed edges by 600mm min between layers, and on opposite sides of the wall. All recessed edges must be backed by a nogging.
<b>Butt Joints</b>	1st and 2nd layers: Fix screws at 200mm max centres and stagger screws. Stagger butt joints by 600mm min on adjoining sheets, between layers and on opposite sides of the wall. All butt joints must be backed by a nogging.
<b>Internal and External Corners</b>	1st layer: Fix at 200mm max centres 2nd layer: Fix at 200mm max centres
<b>Openings</b>	1st layer: Fix at 200mm max centres 2nd layer: Fix at 200mm max centres
<b>Fire Sealant</b>	Use fire sealant around perimeter to maintain fire and acoustic integrity. <i>[Refer to Construction Details]</i>
<b>Joining 1st Layer</b>	Completely fill recess joints and any gaps with GIB X-Block jointing compound. Paper tape is not required.
<b>Joining Face Layer</b>	Use paper tape with two coats of GIB X-Block jointing compound. Fill any gaps with GIB X-Block jointing compound. Finish with a third coat of MastaFinish.

**FIGURE 7 X-Block 3 Layers – All Vertical on Timber Studs**  
Screw Only Method



<b>Fixing</b>	Screw Only Method
<b>Sheet Layout</b>	1st, 2nd and 3rd layers: Vertical
<b>Perimeter</b>	Perimeter screws 10-15mm from sheet edges
<b>Field</b>	1st, 2nd and 3rd layers: Fix screws at 300mm max centres.
<b>Recessed Edges</b>	1st, 2nd and 3rd layers: Fix screws at 200mm max centres and stagger screws. Stagger recessed edges by 600mm min between layers, and on opposite sides of the wall. All recessed edges must be back by a stud.
<b>Butt Joints</b>	1st, 2nd and 3rd layers: Fix screws at 200mm max centres and stagger screws. Stagger butt joints by 600mm min on adjoining sheets, between layers and on opposite sides of the wall. All butt joints must be backed by a nogging.
<b>Internal and External Corners</b>	1st, 2nd and 3rd layers: Fix at 200mm max centres
<b>Openings</b>	1st, 2nd and 3rd layers: Fix at 200mm max centres
<b>Fire Sealant</b>	Use fire sealant around perimeter to maintain fire and acoustic integrity. <i>[Refer to Construction Details]</i>
<b>Joining 1st and 2nd Layers</b>	Completely fill recess joints and any gaps with GIB X-Block jointing compound. Paper tape is not required.
<b>Joining Face Layer</b>	Use paper tape with two coats of GIB X-Block jointing compound. Fill any gaps with GIB X-Block jointing compound. Finish with a third coat of MastaFinish.

**FIGURE 8 X-Block 2 Layers**  
Screw Only Method

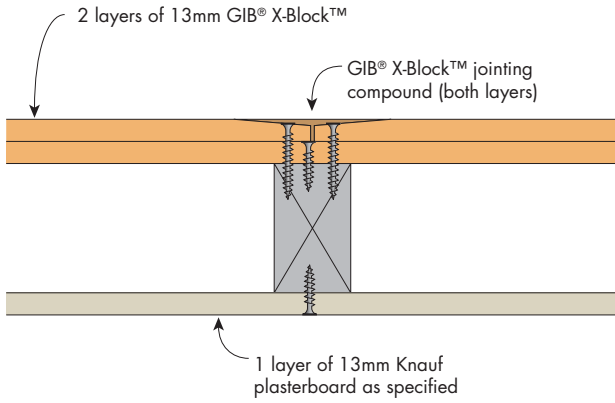


<b>Framing</b>	Timber or Steel Joists or Steel Furring Channel
<b>Fixing</b>	Screw Only Method
<b>Perimeter</b>	Perimeter screws 10-15mm from sheet edges.
<b>Field</b>	Fix at 200mm max centres
<b>Recessed Edges</b>	Fix on each framing member. Stagger recessed edges by 600mm min between layers.
<b>Butt joints on framing members</b>	Fix at 100mm max centres and stagger screws. Butt joints on the 1st layer may be made on the same joist. Stagger butt joints by 600mm min between layers.
<b>Floating butt joints on 2nd layer</b>	Locate centrally between framing members and laminate to 1st layer at 200mm max centres. Stagger butt joints by 600mm min on adjoining sheets.
<b>Wall Abutment</b>	Cornice: Fix at 200mm max centres Square Set: Fix at 150mm max centres
<b>Openings and Control Joints</b>	Fix at 200mm max centres
<b>Fire Sealant</b>	Use fire sealant around perimeter to maintain fire and acoustic integrity. <i>[Refer to Construction Details]</i>
<b>Jointing 1st Layer</b>	Completely fill recess joints and any gaps with GIB X-Block jointing compound. Paper tape is not required
<b>Jointing Face Layer</b>	Use paper tape with two coats of GIB X-Block jointing compound. Fill any gaps with GIB X-Block jointing compound. Finish with a third coat of MastaFinish.

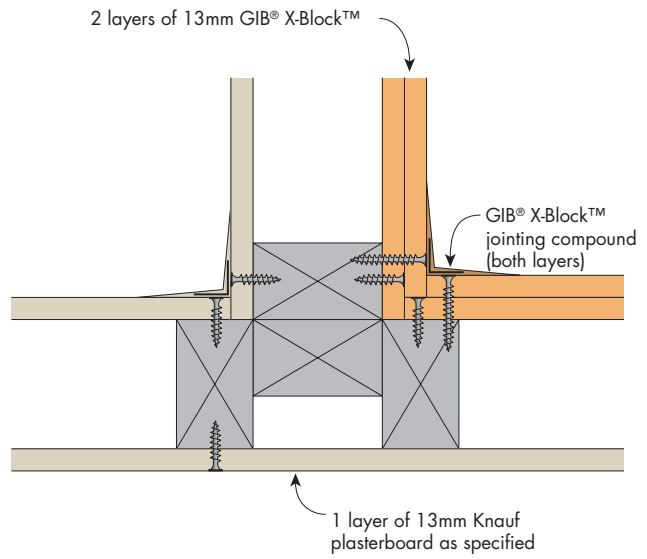


# FIRE RATED AND NON-FIRE RATED WALL JUNCTIONS, DOORS AND WINDOWS – PLAN VIEW

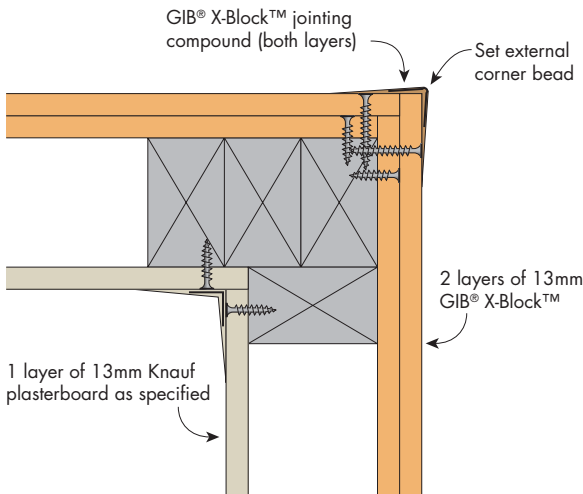
Systems KX1 and KX5 only



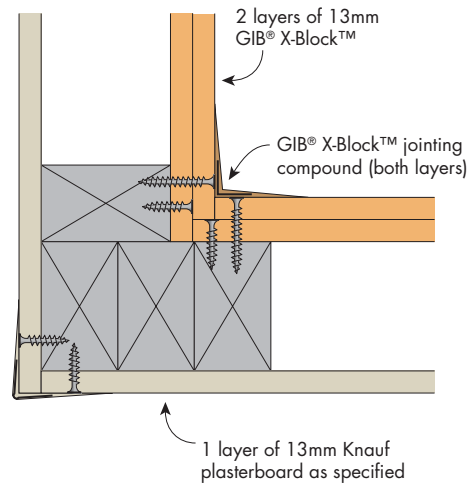
**FIGURE 9 Typical Section**



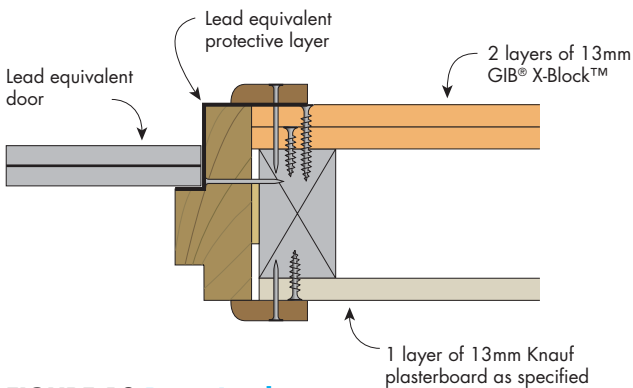
**FIGURE 10 T Junction**



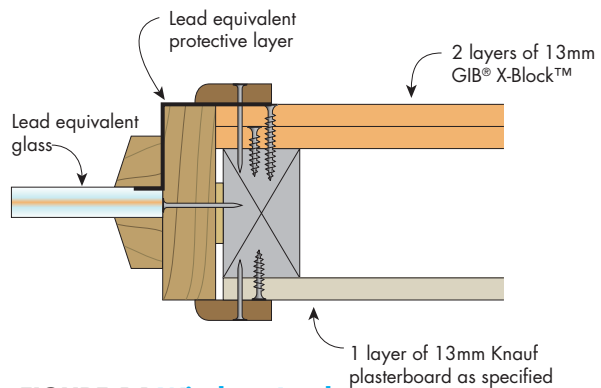
**FIGURE 11 External Corner**



**FIGURE 12 Internal Corner**



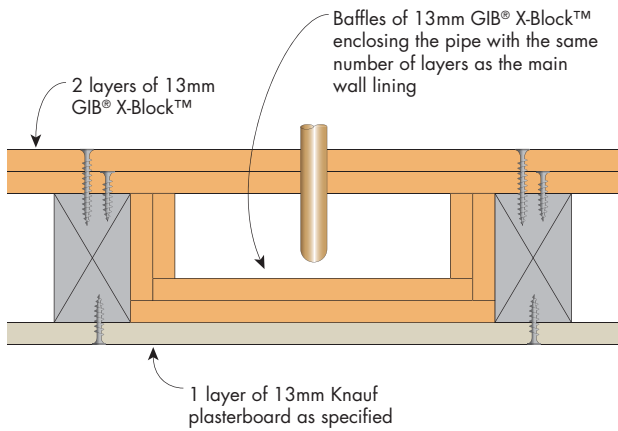
**FIGURE 13 Door Jamb**



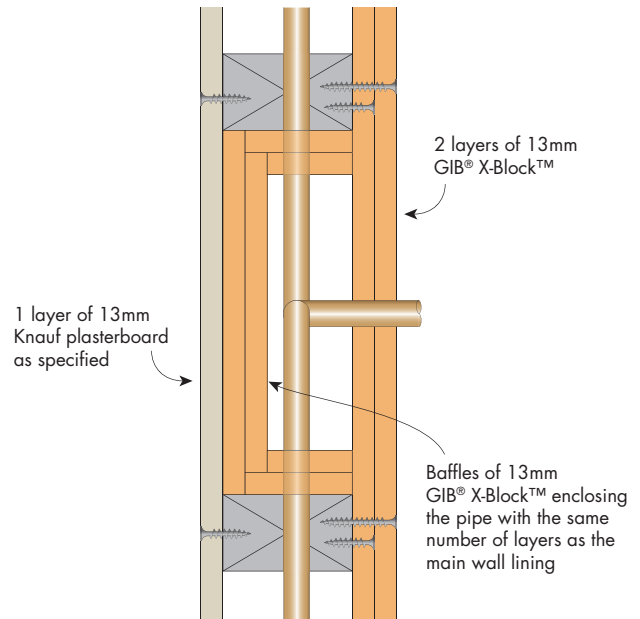
**FIGURE 14 Window Jamb**

# FIRE RATED AND NON-FIRE RATED PENETRATIONS

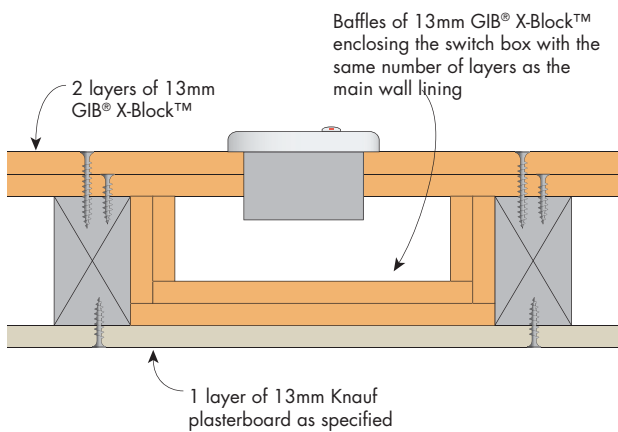
Systems KX1 and KX5 only



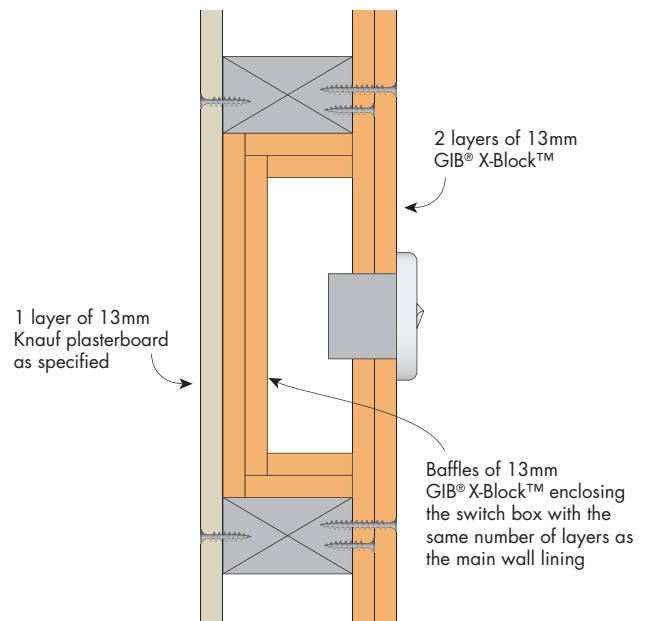
**FIGURE 15 Pipe Penetration**  
Plan view



**FIGURE 16 Pipe Penetration**  
Elevation



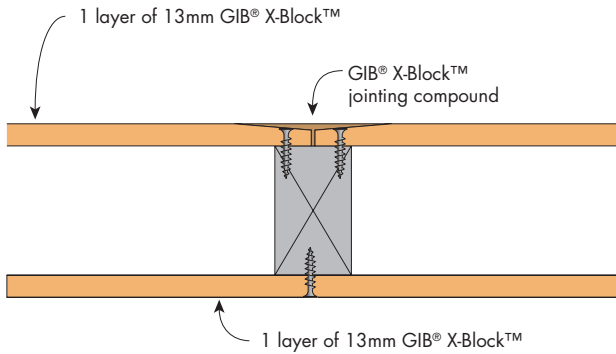
**FIGURE 17 Switch Boxes**  
Plan view



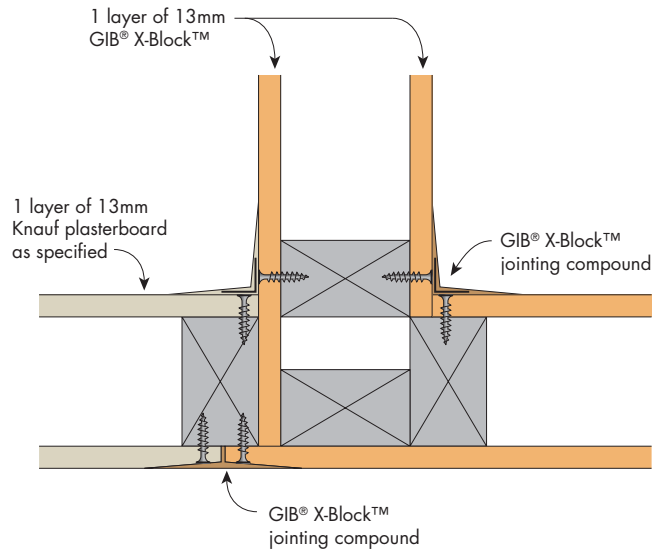
**FIGURE 18 Switch Boxes**  
Elevation

# NON-FIRE RATED WALL JUNCTIONS, DOORS AND WINDOWS – PLAN VIEW

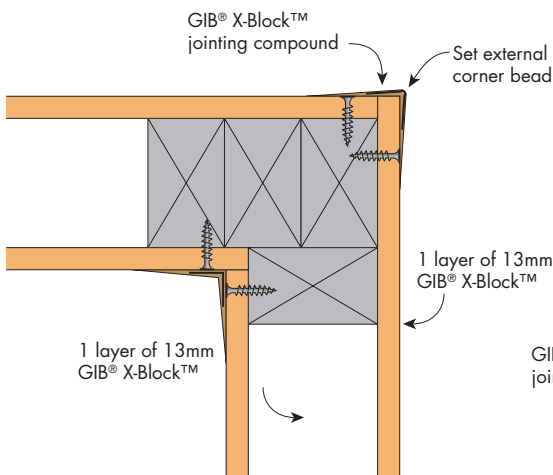
System KX2 only



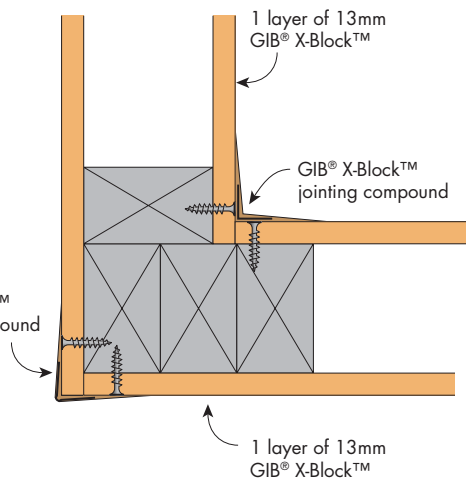
**FIGURE 19 Typical Section**



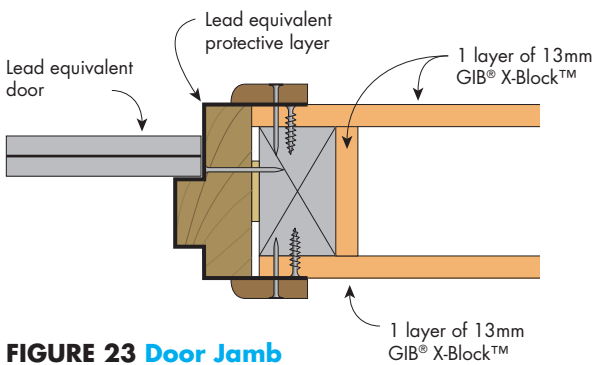
**FIGURE 20 T Junction**



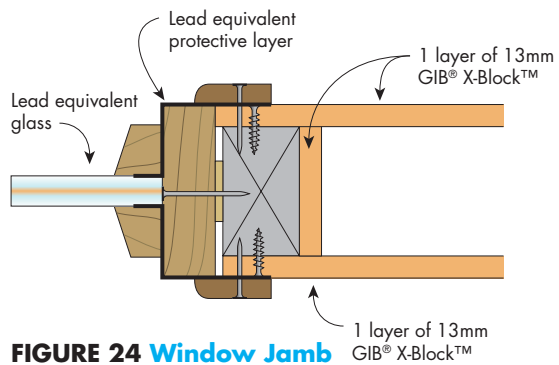
**FIGURE 21 External Corner**



**FIGURE 22 Internal Corner**



**FIGURE 23 Door Jamb**

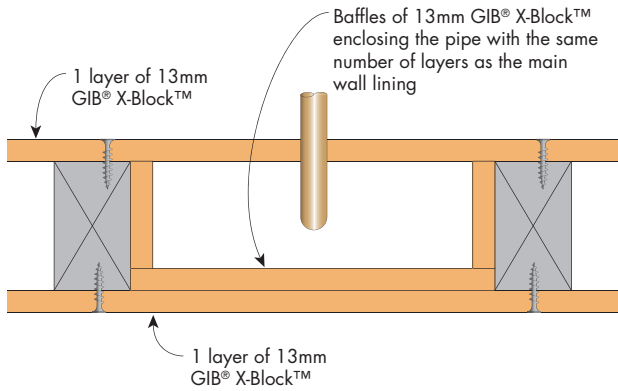


**FIGURE 24 Window Jamb**

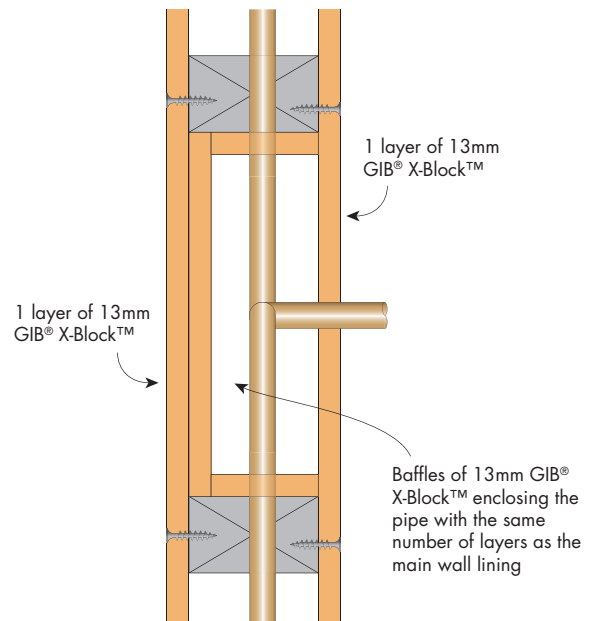
# NON-FIRE RATED

## PENETRATIONS

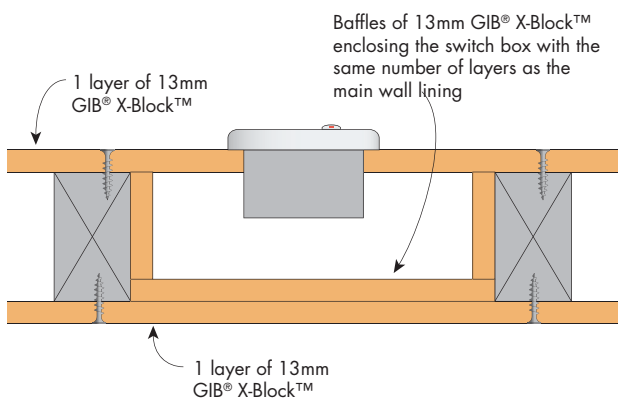
System KX2 only



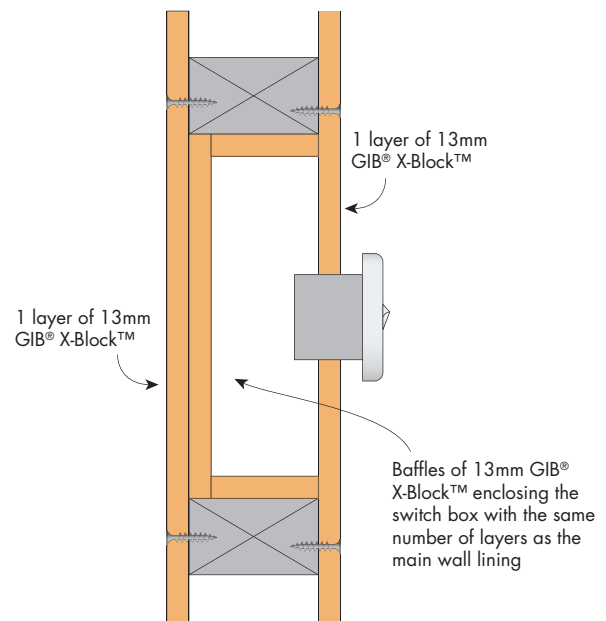
**FIGURE 25 Pipe Penetration**  
Plan view



**FIGURE 26 Pipe Penetration**  
Elevation



**FIGURE 27 Switch Boxes**  
Plan view

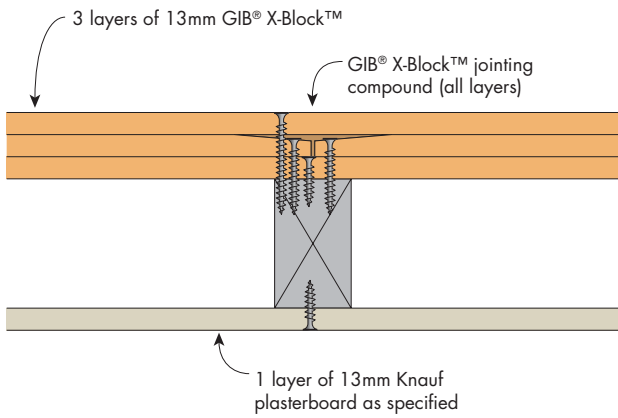


**FIGURE 28 Switch Boxes**  
Elevation

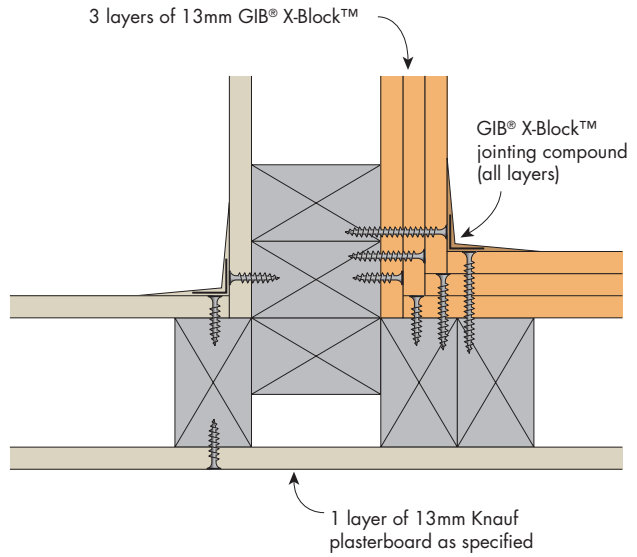


# FIRE RATED AND NON-FIRE RATED WALL JUNCTIONS, DOORS AND WINDOWS - PLAN VIEW

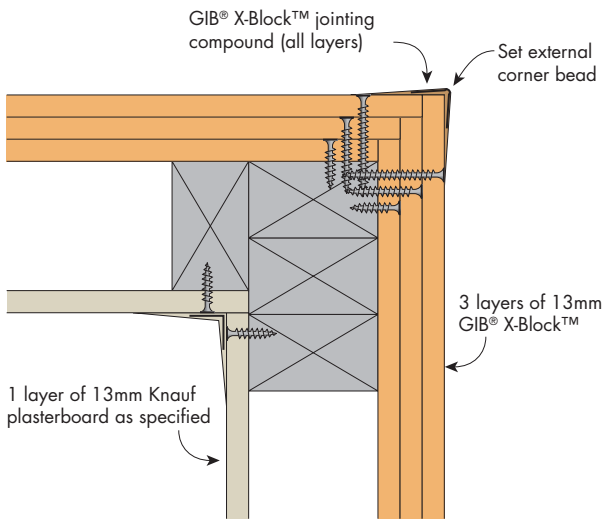
Systems KX3 and KX6 only



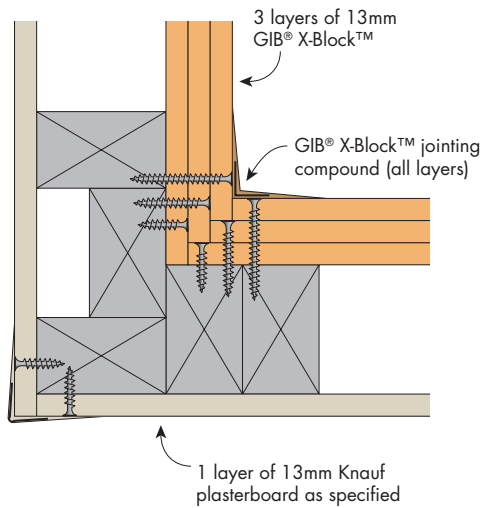
**FIGURE 29 Typical Section**



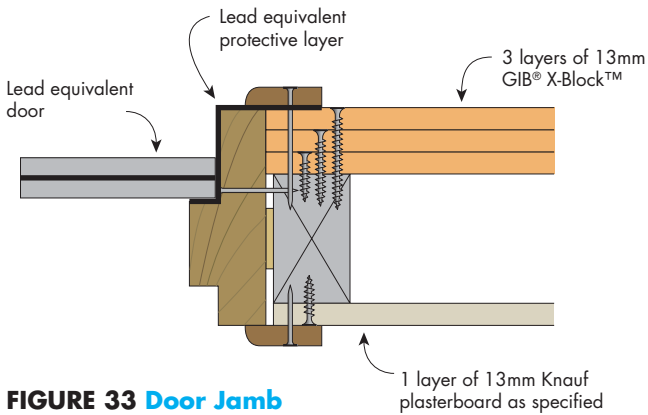
**FIGURE 30 T Junction**



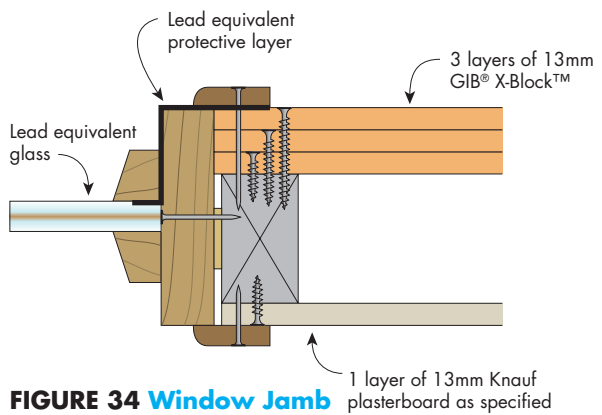
**FIGURE 31 External Corner**



**FIGURE 32 Internal Corner**



**FIGURE 33 Door Jamb**

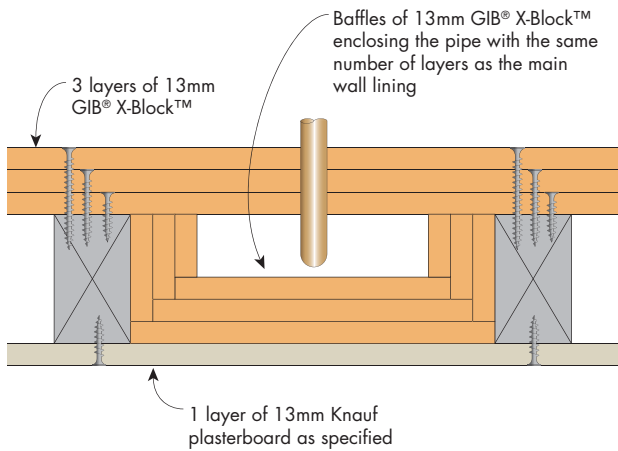


**FIGURE 34 Window Jamb**

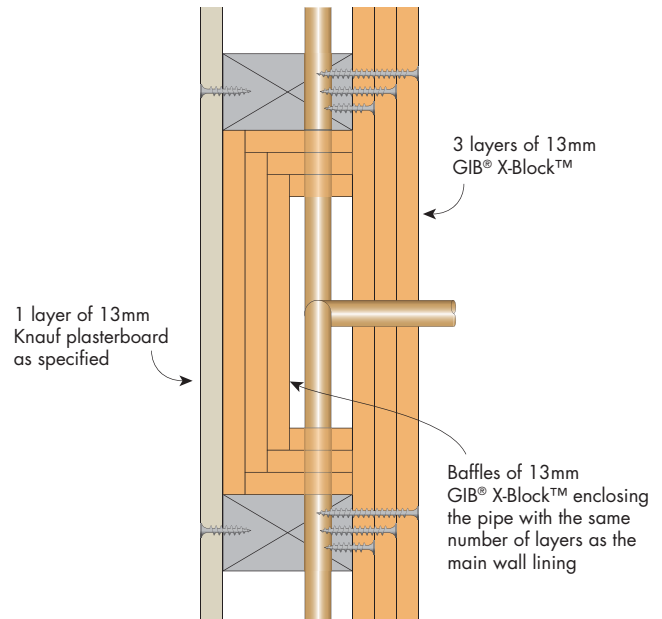


# FIRE RATED AND NON-FIRE RATED PENETRATIONS

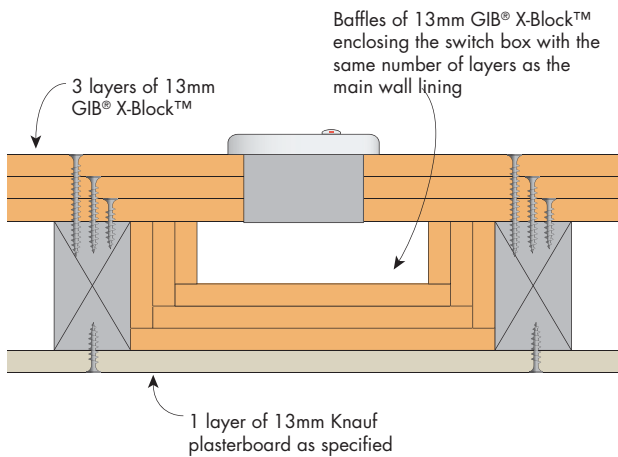
Systems KX3 and KX6 only



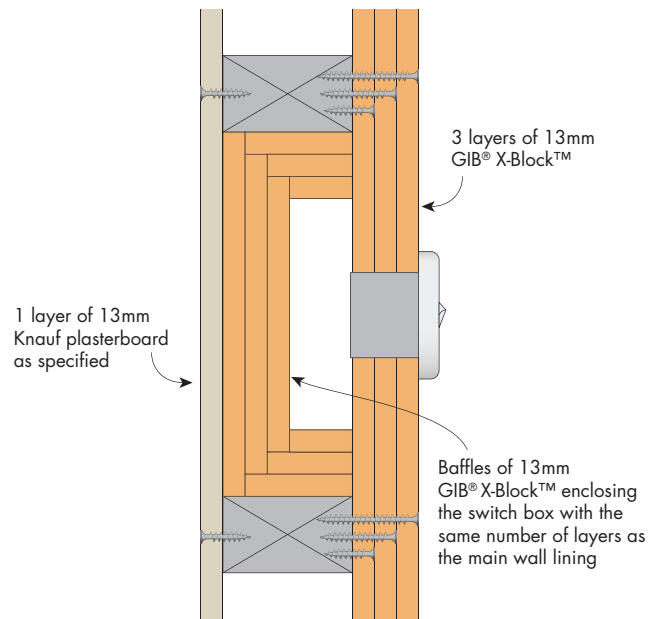
**FIGURE 35 Pipe Penetration**  
Plan view



**FIGURE 36 Pipe Penetration**  
Elevation



**FIGURE 37 Switch Boxes**  
Plan view

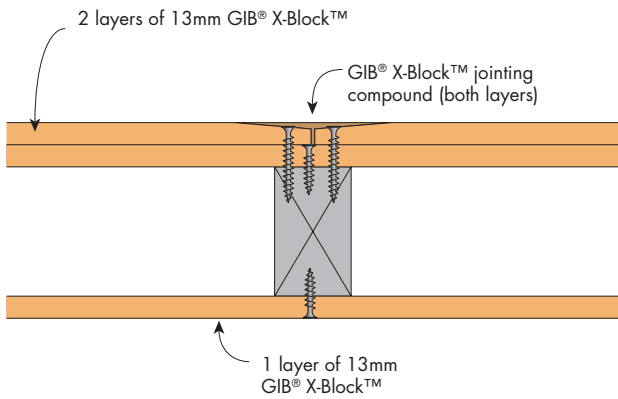


**FIGURE 38 Switch Boxes**  
Elevation

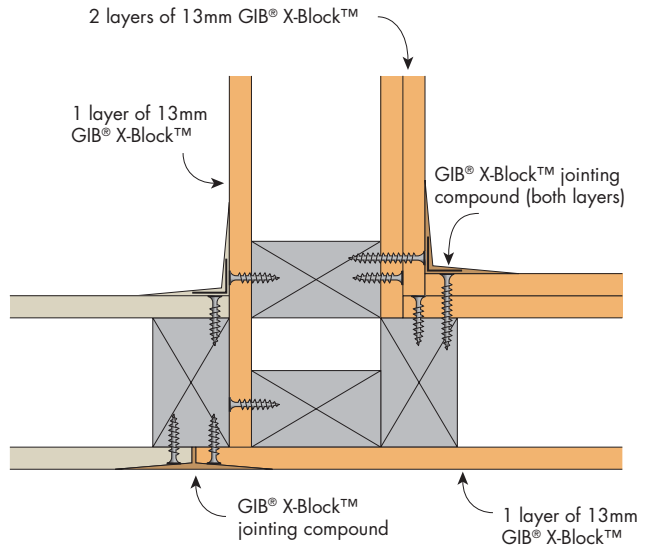


# FIRE RATED WALL JUNCTIONS, DOORS AND WINDOWS – PLAN VIEW

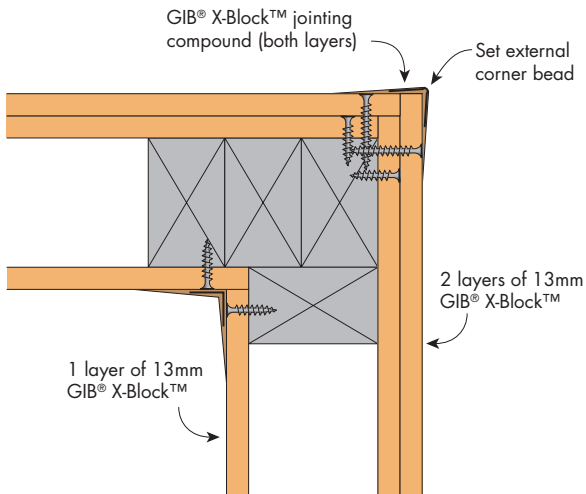
System KX7 only



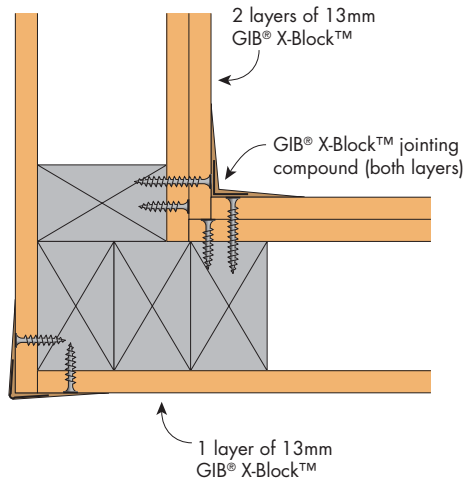
**FIGURE 39 Typical Section**



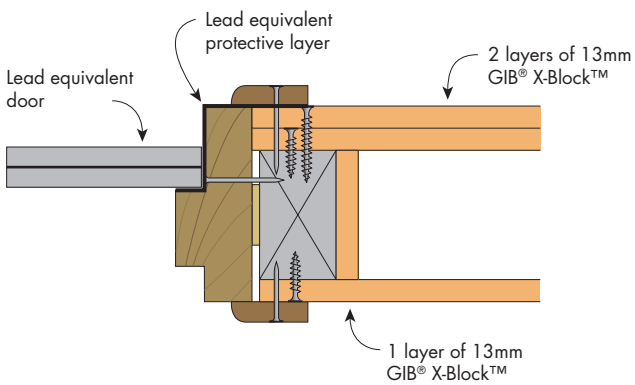
**FIGURE 40 T-Junction**



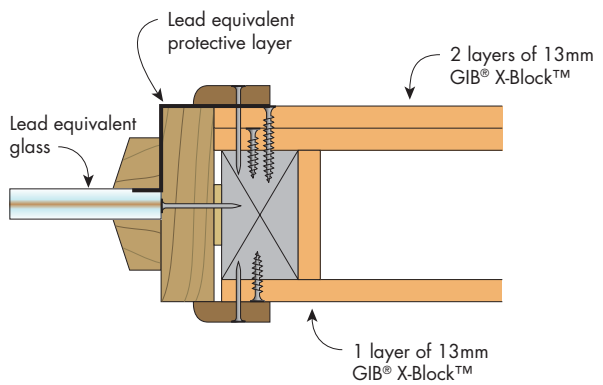
**FIGURE 41 External Corner**



**FIGURE 42 Internal Corner**

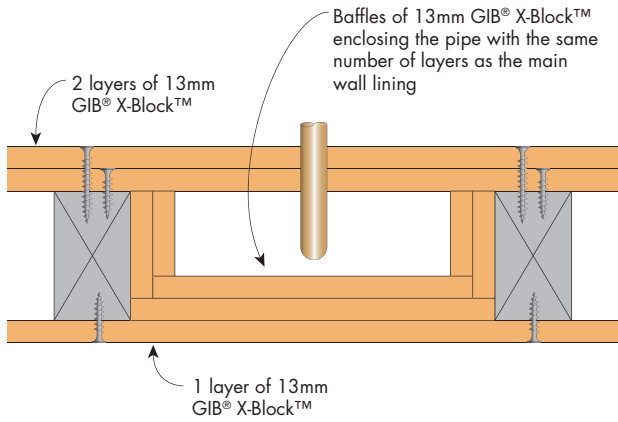


**FIGURE 43 Door Jamb**

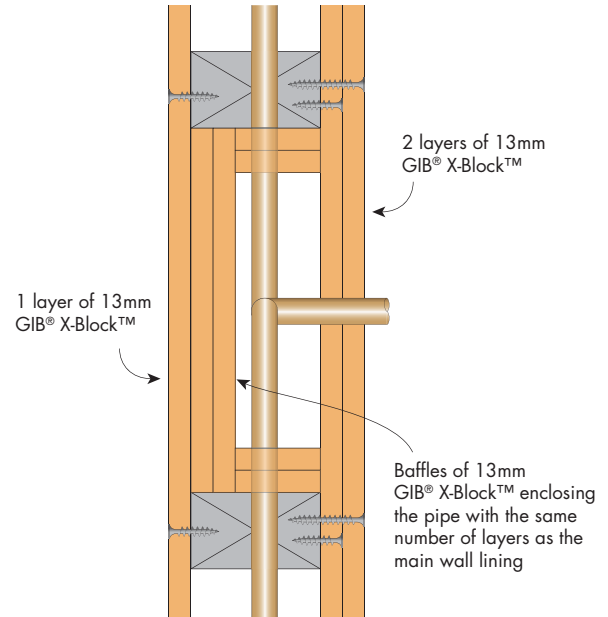


**FIGURE 44 Window Jamb**

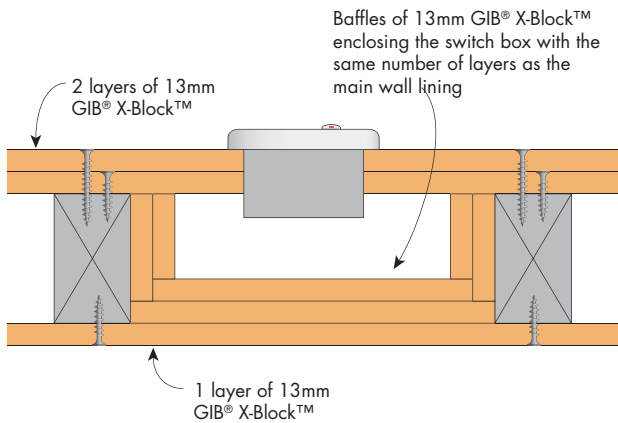
**FIRE RATED  
PENETRATIONS**  
System KX7 only



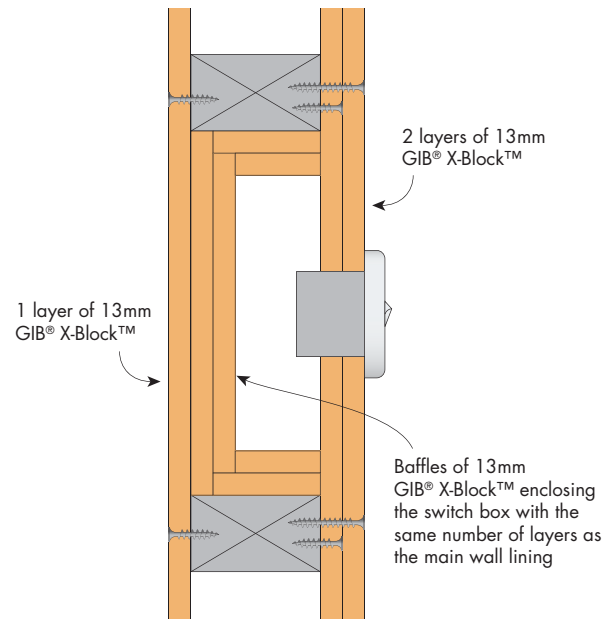
**FIGURE 45 Pipe Penetration**  
Pipe penetration – Plan view



**FIGURE 46 Pipe Penetration**  
Elevation



**FIGURE 47 Switch Boxes**  
Plan view



**FIGURE 48 Switch Boxes**  
Elevation